

## Claims

- [c1] 1. An epitaxial growing method for a lead zirconate titanate (PZT) thin film with a lattice structure, comprising: providing a substrate; forming a lanthanum nickel oxide (LNO) thin film by an in-situ method such that the lanthanum nickel oxide (LNO) thin film is grown with a lattice structure; and forming the PZT thin film on the LNO thin film by an in-situ method such that the PZT thin film is epitaxially grown with a lattice structure the same as the LNO thin film at a temperature of about 350 to about 500 degrees Celsius.
- [c2] 2. The method of claim 1, wherein the PZT thin film grows at the temperature of about 350 to about 450 degrees Celsius.
- [c3] 3. The method of claim 1, wherein the LNO thin film grows at a temperature of about 350 to about 500 degrees Celsius.
- [c4] 4. The method of claim 1, wherein the epitaxial growing of the PZT thin film by sputtering uses a  $\text{Pb}_y\text{Zr}_x\text{Ti}_{1-x}\text{O}_3$  (x and y are real numbers,  $y > 1$ ) target.
- [c5] 5. The method of claim 1, wherein the PZT thin film is formed under an argon gas environment.
- [c6] 6. The method of claim 1, wherein the PZT thin film is formed under an argon gas pressure of about 1 mTorr to about 50 mTorr.
- [c7] 7. The method of claim 1, wherein the method is applicable for a fabrication of a dynamic random access memory.
- [c8] 8. The method of claim 1, wherein the method is applicable for a fabrication of a ferroelectric random access memory.
- [c9] 9. The method of claim 1, wherein the method is applicable for a fabrication of a piezoelectric device.
- [c10] 10. The method of claim 1, wherein the method is applicable for a fabrication of a pyroelectric device.
- [c11] 11. The method of claim 1, wherein the lattice structure includes a Perovskite

phase.

- [c12] 12. A fabrication method of a capacitor, comprising:providing a substrate;forming a barrier layer on the substrate;forming a lanthanum nickel oxide (LNO) thin film as a bottom electrode for the capacitor by an in-situ method such that the lanthanum nickel oxide (LNO) thin film is epitaxially grown with a lattice structure; and forming a lead zirconate titanat (PZT) thin film on the LNO thin film by the in-situ method such that the PZT thin film with a lattice structure the same as the LNO thin film is epitaxially grown at a temperature of about 350 to about 500 degrees Celsius.
- [c13] 13. The method of lcaim 12, wherein the substrate comprises CMOS (complementary metal oxide semiconductor) devices and interconnects.
- [c14] 14. The method of claim 12, wherein a metal interconnect structure and an inter-metal dielectric layer are already formed on the substrate, and the barrier layer is formed on top of the inter-metal dielectric layer.
- [c15] 15. The method of claim 12, wherein the barrier layer is selected from the group consisting of titanium, titanium nitride, titanium oxide, titanium tungsten nitride, titanium aluminum nitride, tantalum nitride and platinum.
- [c16] 16. The method of claim 12, wherein an upper electrode is selected from the group consisting of lanthanum nickel oxide, platinum, iridium dioxide, ruthenium dioxide, ruthenium and iridium.
- [c17] 17. The method of claim 12, wherein the PZT thin film grows at a temperature of about 350 degrees Celsius to 450 degrees Celsius.
- [c18] 18. The method of claim 12, wherein the LNO thin film grows at a temperature of about 350 degrees Celsius to 500 degrees Celsius.
- [c19] 19. The method of claim 12, wherein sputtering the substrate uses a  $\text{Pb}_y\text{Zr}_x\text{Ti}_{1-x}\text{O}_3$  (x and y are integers,  $y > 1$ ) target.
- [c20] 20. The method of claim 12, wherein the PZT thin film grows under an argon environment.

[c21] 21. The method of claim 12, wherein the lattice structure includes a Perovskite phase.